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REVIEW

Radioactive waste policy and legislation: 50 years on from the 1960 Act

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Online at stacks.iop.org/JRP/31/309**Abstract**

Over the past 50 years a comprehensive regulatory framework for radioactive substances in the UK has been progressively introduced, important initial milestones being the white paper Cmnd 884 and the Radioactive Substances Act 1960. During the 1970s and 1980s there were a succession of enquiries and white papers which developed from the growing awareness of the problems of the nuclear waste legacy. This was followed by a comprehensive policy white paper in 1995: Cm 2919. In 1990, 1993, 1995 and 2005 some aspects of the 1960 Act were updated. The most recent, and most radical, modernisation took place in 2010, when the Act was incorporated into the Environmental Permitting Regulations, in England and Wales. Currently a major review of the exemption orders and exclusion criteria under the radioactive substances legislation is close to completion, which will complete the current phase of modernisation of the regulatory framework.

1. Introduction

The purpose of this paper is to review the development of radioactive waste policy and legislation over the past fifty years, as well as to suggest the future direction it may take. In a paper of this length it is not possible to cover any areas in depth, rather the intention is to set out the key milestones that have led to the current framework for radioactive waste regulation.

The first comprehensive regulatory framework for radioactive waste was established in the UK through the Radioactive Substances Act 1960. This built on some earlier developments. The first requirement for authorisation of radioactive disposal began six years earlier, in 1954 under the Atomic Energy Authority Act, although this only covered UKAEA sites. The circumstances at the time were such that the UK was developing its atomic power programme and it was recognised that control of the management and disposal of radioactive wastes was of key importance. The AEA Act was then extended in 1959 to cover the new civil nuclear reactor programme (under the Central Electricity Generating Board), by the Nuclear

Installations (Licensing and Insurance) Act. Those interested in the earlier phase of regulation should consult the author's book *Radioactive Waste—Control and Controversy: The History of Radioactive Waste Regulation in the UK* [1].

The most significant step forward was actually taken in November 1959, with the publication of the first white paper in this field: Cmnd 884 The Control of Radioactive Wastes [2]. This set a framework which has largely endured to the present day. Apart from the 50 year milestone it is now a particularly appropriate time to review the history of radioactive waste regulation, as RSA93 has just been replaced by the Environmental Permitting Regulations 2010 in England and Wales.

2. Cmnd 884—fundamental principles

Although radioactive waste disposals from the nuclear sector were covered by the 1954 and 1959 Acts, by the late 1950s it had become clear that regulation of waste from the non-nuclear sector was also needed. Use of radioactive materials was becoming widespread in hospitals, universities and industry. Therefore, at the invitation of the Minister of Housing and Local Government, an expert panel of the Radioactive Substances Advisory Committee was set up in 1957 to advise him on the appropriate regulatory regime. The result was Cmnd 884; the first white paper from government on radioactive waste matters. The technical report, which forms the bulk of the white paper, was written by the panel's technical secretary, Arthur W Kenny, who was the chief radiochemical inspector.

The report was both comprehensive and visionary. It set out all of the main sources of radioactive wastes at that time and concluded that, in most cases, control was needed. It discussed the hazards from radioactive waste disposal and set out the principles of a control framework in terms we are familiar with today: justification, optimisation and limitation. It recommended local disposal of wastes wherever possible. Finally, the authors surveyed the legal framework of the time, concluded this was inadequate for the special problems posed by radioactive wastes and recommended new legislation, which should be enforced centrally.

The report is a pleasure to read for its clear analysis and compelling conclusions. I will repeat paragraph 111, which is as good a summary of a realistic approach to the hazards of radioactive waste as we could find anywhere: *the population is, of course, subject to a certain amount of irradiation from natural sources. It could be reduced by living underground or in homes constructed of thick non-radioactive materials but the cost and inconvenience would not be considered justified. A similar situation exists with radioactive waste disposal. It is not possible to achieve it without any irradiation of the public. The irradiation can be reduced to a very low level by suitable precautions specified later, but further reduction would often require a disproportionate expenditure of effort and money. It would be disproportionate in the sense that if spent in other fields, e.g. transport, factories and homes, more serious risks might be averted.*

The government accepted all the recommendations of the report and committed itself to introducing a new Radioactive Substances Bill.

3. Radioactive Substances Act 1960—implementation

The Act resulting from the recommendations in Cmnd 884 went onto the statute book in June 1960. It provided for a system of regulatory permissions: registration for keeping and use of radioactive materials and authorisation for the accumulation and disposal of radioactive wastes. It applied to all users and producers except the defence sector and domestic situations. It contained a wide definition of radioactive material and waste, but it did include exclusion levels for low levels of the most important natural radio elements.

However, implementation was not as straightforward as originally foreseen, and this is perhaps one area where Cmnd 884 did fall short. For it proved very difficult to draw the line between activity levels that should be regulated and those for which full control under the Act was impractical or unnecessary. This was particularly the case for naturally occurring radioactive materials (NORM) where the general exclusion levels in Schedule 3 of the Act (based on analyses of substances routinely used by industry) were too low to exclude, for example, many geological specimens, materials incorporating thorium (such as gas mantles) and some laboratory reagents (such as uranyl nitrate). Clearly, control of such widely used materials was impractical and unnecessary and a way had to be found to exclude or exempt them from control under the Act.

This was achieved by way of exemption orders. These were statutory instruments (secondary legislation) which described the types of radioactive materials and wastes exempted from control and any conditions associated with the exemption. These conditions included limits on activity, quantity, the need to keep records etc. Arriving at workable limits and conditions involved extensive discussions with the appropriate industrial and commercial sectors, which took considerable time. As a result the Radioactive Substances Act 1960 (RSA60) was not brought into force until three years later, in December 1963.

4. Developments in the 1970s and 1980s

Legislation on radioactive waste remained largely untouched during this period, but there were policy developments largely based on the growing awareness of the problems posed by the nuclear waste legacy from civil and defence programmes. This was first highlighted when the Royal Commission on Environmental Pollution turned its attention to radioactive waste in 1976 with its report 'Nuclear Power and the Environment: Cmnd 6618' (the 'Flowers Report') [3]. This highlighted the increasing inventory of radioactive wastes at nuclear sites and recommended *inter alia* that no commitment should be made to a large programme of nuclear fission power until safe containment of highly active radioactive wastes had been demonstrated. The government's response, in the white paper Cmnd 6820 [4], was the first real attempt to address the issue of nuclear waste disposal specifically, particularly for high level wastes. It accepted that it needed to secure the programmed disposal of wastes accumulated at nuclear sites and that they should be disposed of 'in appropriate ways, at appropriate times and in appropriate places'. It gave this responsibility for nuclear waste management policy to the Secretary of State for the Environment, together with the Secretaries of State for Scotland and Wales. The report also led to the independent Radioactive Waste Management Advisory Committee being established in 1978 to advise government on development and implementation of policy for civil radioactive waste management.

A feature of this period was the number of public enquiries that were held

- The Windscale Inquiry of 1977 on the Thermal Oxide Reprocessing Plant (THORP) planning application.
- The Sizewell B Inquiry of 1983–85.
- The Hinkley Point C Inquiry of 1988–89.

All of the reports from these enquiries drew attention to radioactive waste disposal, as one of a very wide range of issues. The Windscale inspector criticised the setting of discharge limits by the regulators. The Sizewell B inspector pointed out that large scale storage of intermediate level waste (ILW) and low level waste (LLW) on nuclear sites was not a satisfactory long term solution. The Hinkley inspector was critical of both the failure to decide on a site for a deep repository for high level wastes and of the setting of gaseous and liquid discharge limits.

These criticisms, together with the outstanding actions from the Royal Commission report, led to two more white papers on radioactive waste:

- Cmnd 8607 [5] 1982—this explicitly incorporated the International Commission on Radiological Protection (ICRP) principles of justification and optimisation in policy for the first time, implemented some recommendations of an expert panel set up to review Cmnd 884 and led to the 1982 ‘Guide to the Administration of the Act’, which clarified the activity limits for various disposal routes for the different categories of radioactive waste.
- Cmnd 9852 [6] 1986—this was a response to a report by the House of Commons Select Committee on radioactive waste policy, but did not itself set any significant new policy.

5. Cm 2919—review of radioactive waste policy [7]

This white paper, published in 1995, represents the last comprehensive review of radioactive waste policy in the UK. It described the international guidelines and regulations and the national framework of policy, regulation, monitoring and structure of the nuclear industry. Then it set out the radiological protection principles, waste categories and disposal options. Finally it clarified a number of specific policies in areas such as high level waste, the Nirex repository, decommissioning, import/export etc.

However many, if not most, individual policies have changed since then and currently there is no one place where current policies can be found. Some of the major developments are as follows:

- Decommissioning policy [8]—updated following the setting up of the Nuclear Decommissioning Authority in the Energy Act 2004. The new policy takes into account, more explicitly than before, the need to recognise a range of possible final uses for decommissioned sites, the need for public consultation on these final uses, the desirability of waste minimisation and recycling and not creating wastes for which there is no management solution likely to be available.
- Low level waste policy—new policy statement published in March 2007 [9]. This created a new category of radioactive waste: high volume very low level waste (LLW) which is suitable for landfill disposal, subject to a site specific permit. It also set out roles and responsibilities, and the requirement for operators to have LLW waste management plans.
- Managing Radioactive Waste Safely Cm 7386 [10]—new policy for geological disposal of higher level wastes, published in November 2008. The white paper set out the role of the Nuclear Decommissioning Authority in developing a geological repository, a community partnership approach to site selection, the UK radioactive waste inventory and arrangements for sound regulation.
- Statutory guidance on radioactive discharges into the environment [11]—update of policy on discharges to the marine environment involving progressive and substantial reductions in discharges, as required by the Oslo and Paris Convention (OSPAR). The guidance also highlights the move in England and Wales from best practicable means (BPM) and best practicable environmental option (BPEO) to best available techniques (BAT) for the regulation of radioactive discharges.

6. Devolution

The legislative framework for devolution in the UK is set out in the Scotland Act 1998, the Government of Wales Act 1998 and the Northern Ireland Act 1998. There is also a non-

legislative framework of concordats, agreements between government departments and the devolved institutions, under a memorandum of understanding [12].

Under this legislation, responsibility for radioactive waste policy was devolved to the Scottish Executive, the Welsh and Northern Ireland Assemblies. Although RSA93 has remained very largely the same across the whole UK (apart from some minor differences in exemption orders) the Devolved Administrations (DAs) were free to develop their own policies on the management and disposal of radioactive waste. In general, consistency has been maintained across the UK but one major area of difference is policy for disposal of higher level wastes. The Scottish Executive, led by the Scottish National Party, withdrew from sponsorship of the 2008 white paper 'Managing Radioactive Waste Safely'. Since then Scotland has developed its own policy for higher activity wastes, on which it has recently consulted [13].

7. Further legislative developments

RSA60 was updated in 1990 by amendments made under the Environmental Protection Act and subsequently by the Environment Act in 1995. The former introduced a charging system for permits, to implement the 'polluter pays' policy, and public registers to provide transparency. These and some other minor amendments were consolidated in the Radioactive Substances Act 1993 (RSA93). The subsequent 1995 amendments were mainly concerned with the regulatory authority. The Environment Act set up the Environment Agency (EA) in England and Wales as the sole regulator for all pollution permitting regimes, including radioactive substances. One significant result of this was that the Ministry of Agriculture, Fisheries and Food, which was previously a joint authorising body for discharges from nuclear sites, lost the role which it had had since 1954 and became instead a statutory consultee.

A subsequent important development was the incorporation of security requirements within the radioactive substances regulation regime. This partly originated from the terrorist attack of 11 September 2001 in New York which, among other things, prompted a review of the security of radioactive materials in the UK. A parallel development was the European Union (EU) High Activity Sealed Sources (HASS) Directive of 2003, which resulted mainly from concern over the radiological consequences of loss of large sealed sources, such as occurred in the Goiânia incident in Brazil in 1987, and the accidental smelting of several other sources. A decision was taken to implement the HASS Directive in the UK via the Radioactive Substances Act, rather than through the Ionising Radiation Regulations. The legislative change to RSA93 was made in the Highly Active Sealed Radioactive Sources and Orphan Sources Regulations 2005. This was a significant development because, for the first time, the environment agencies effectively became security regulators. The government had decided that it was important to use this opportunity to introduce a strong regime to cover the security of a wider range of sources than HASS, so the regulations covered sources '... of a similar level of potential hazard to a high activity source'. The stock of existing permits under RSA93 were modified to include explicit security conditions and the regulators began doing inspections with police counter-terrorism security advisors (CTSAs). Furthermore a major project was implemented by the regulators, with £9M of government funding, to recover surplus sources and arrange their appropriate disposal. This was completed in 2009 [14].

7.1. *The Environmental Permitting Regulations (England and Wales) 2010*

These regulations (EPR) can be seen as the next major step in modernising environmental regulation after the Environment Act of 1995. The EA in England and Wales was well established and had taken a number of steps to streamline its regulatory systems, including

national permitting centres and integrated enforcement teams. However, further progress was hampered by the fundamental procedural differences in the regulatory regimes themselves.

The EPR now incorporate all the provisions of RSA93, except exemption orders, in a consistent permitting framework that also covers integrated pollution prevention and control, discharges to controlled waters and to groundwater, conventional waste, mining waste and battery waste. This will enable the EA to introduce a single permitting, compliance and charging system for most of the regulatory regimes that it enforces. This should enable common approaches to sector-based permitting and lead to significant efficiency savings.

These changes in EPR are largely procedural. There have only been two changes to the standard or scope of radioactive substances regulation (RSR). The most important of these is the introduction of staged regulation for certain disposal facilities. This was mandated by the 2008 white paper 'Managing Radioactive Waste Safely' [10] to remedy a deficiency in RSA93; that no authorisation was needed until radioactive waste was to be disposed. This meant that a geological repository could be developed over a number of years without any legal control from the regulator, until it was ready for the emplacement of radioactive waste. At this stage the design would be fixed, all the capital would have been invested and the regulator could only, essentially, refuse or agree.

To remedy this unacceptable position the EPR now makes 'intrusive investigation' of a potential site for radioactive waste disposal a 'radioactive substances activity' which requires a permit, even though it may be many years before there is any radioactive waste on the site.

The second change to scope is a relatively minor one; to simplify the permitting requirement for transfers of radioactive waste between sites while maintaining the transparency of information provided to local authorities.

Finally, it is hoped that the structure and purpose of the legislation will be much easier to understand. The structure of the EPR is based on the parent EU directives that the permitting regime implements, with the details of each regime in a separate schedule of the regulations. The RSR provisions are in Schedule 23. This clearly shows which provisions derive from the Basic Safety Standards (BSS) Directive and which from the HASS Directive. The specific requirements which were once in the BSS Directive and HASS Regulations, including the public dose limit and constraints, are now in the parent legislation.

There is also comprehensive government guidance to the RSR regime [15], in England and Wales, for the first time since the last 'Guide to the Act' was published in 1982 [16]. The EA has also published its own guidance on how to achieve compliance with the new regulations [17].

At present there are no clear plans for Scotland and Northern Ireland to adopt a similar environmental permitting framework, and RSA93 remains unchanged in those administrations.

7.2. Exemption order (EO) review

Under this review there are potentially significant changes to the scope and standard of regulation. As mentioned above, the EOs set the level of activity and type of use for which permitting is not required, subject to compliance with any conditions contained in the order. The current EOs were largely enacted in 1962/3 but several have been added over the years to deal with particular issues (such as radioactivity in natural gas supplies) so the exemption framework has become inconsistent, unwieldy and sometimes irrelevant to modern requirements.

There have been a number of attempts to revise the EO framework over the past 20 years. Much technical work was done but nothing significant changed, although a few individual orders were updated, most notably the Substances of Low Activity EO in 1986 and the Hospitals EO in 1990.

The current review was started in 2006 and will not be completed until 2011. It is far more radical than anything attempted before as it aims to achieve a fundamental restructuring of the exemption framework. The review is also a UK wide programme and the intention will be to implement the same framework across all four administrations at the same time.

The current proposal is for one EO containing all the exemptions in tabular form, as follows:

- Exemption of solid, liquid or gaseous material by total activity or activity concentration.
- Exemption for items (e.g. sealed sources) by total activity in the item or on the premises.
- Exemption of waste by activity concentration or total activity disposed of in a certain period.
- Exemption of aqueous liquid waste by activity concentration.

There are appropriate conditions which apply to all exemptions within a particular category (e.g. liquid waste disposal).

The total activity and concentration thresholds for holdings and disposals of solid, liquid or gaseous material are taken from those in annex 1 of the EU Basic Safety Standards Directive (BSSD). These are based on a public dose criterion of $10 \mu\text{Sv yr}^{-1}$. The holding and disposal thresholds for items are higher, but still based on $10 \mu\text{Sv yr}^{-1}$, because the exposure pathways are constrained by the design of the item.

There are completely new exemption provisions for NORM waste. This allows disposal of up to 10 ktonne yr^{-1} of low level waste, up to an activity concentration of 5Bq g^{-1} . Disposals up to 10Bq g^{-1} are also exempted, subject to a site specific radiological assessment sent to the environmental regulator before the first disposal. These provisions are a more radiologically justified replacement for the current Phosphatic Substances Exemption Order.

Government has also taken the view that it is necessary to modernise the definitions of radioactive material and waste (sections 1 and 2 of RSA93) and to provide exclusions from the legislation for anthropogenic radionuclides, in addition to those for natural radio elements in the current schedule 1 of RSA93. The activity thresholds in the new schedule for exclusion are drawn from EU guidance documents for the BSSD (RPP122 parts 1 and 2) [18] and are based on $10 \mu\text{Sv yr}^{-1}$ for anthropogenic radionuclides and $300 \mu\text{Sv yr}^{-1}$ for natural radionuclides.

Government engaged stakeholders on these proposals in the summer of 2010. Dependent on parliamentary approval, it is planned to lay the regulations in mid 2011, with them coming into effect in October 2011, through amendments to EPR in England and Wales and to RSA93 in Scotland and NI. Sufficient time will be allowed for those who might fall into regulation for the first time, and need a new permit, to gain it. Those who become excluded or exempt and wish to surrender their permit will be able to do so without financial penalty.

8. Future direction and fundamental principles

There are a number of European and international initiatives that may drive some changes in UK policy and legislation. The EU Basic Safety Standards Directive is being revised, as are the International Atomic Energy Agency's Basic Safety Standards. The EU is also developing a directive on spent fuel and radioactive waste management. These are not expected to require major legislative change in the UK, but government will be in a good position to easily implement any necessary provisions, due to the form of the new legislation outlined above.

It would be wrong, however, to leave the impression that radioactive waste policy development is entirely reactive. There are some clear principles on which policy development is based:

- Maintaining the high level of protection of the public at levels of risk at or below 10^{-5} yr^{-1} , as we deal with legacy wastes, develop new nuclear power stations and other peaceful uses of radioactive materials.
- Improving protection of the environment as a whole, particularly of sensitive habitats and ecosystems, as knowledge of the effects of radiation on these systems increases.
- A system of strong, transparent and independent regulation where the level of intervention is proportionate to the hazard and informed by the risk.
- Engagement of local communities in the process of selecting storage and disposal facilities for higher activity wastes.
- Clear and public plans and strategies for the management and disposal of all categories of radioactive waste and spent fuel.
- Implementation of European and international obligations and of best practice.
- Harmonising, as far as practicable, the legislative and compliance requirements for radioactive wastes with those for other pollution permitting regimes.

These principles will guide government in the continuing development of policy to manage radioactive wastes from our nuclear legacy, from any programme of new nuclear reactors and from the wider use of radioactivity in industry, research and the health sector.

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